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NE 24, 1940
UME 29, No. 13

AMERICAN DYESTUFF REPORTER

ICIAL PUBLICATION
of the
PROCEEDINGS
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TEXTILE CHEMISTS
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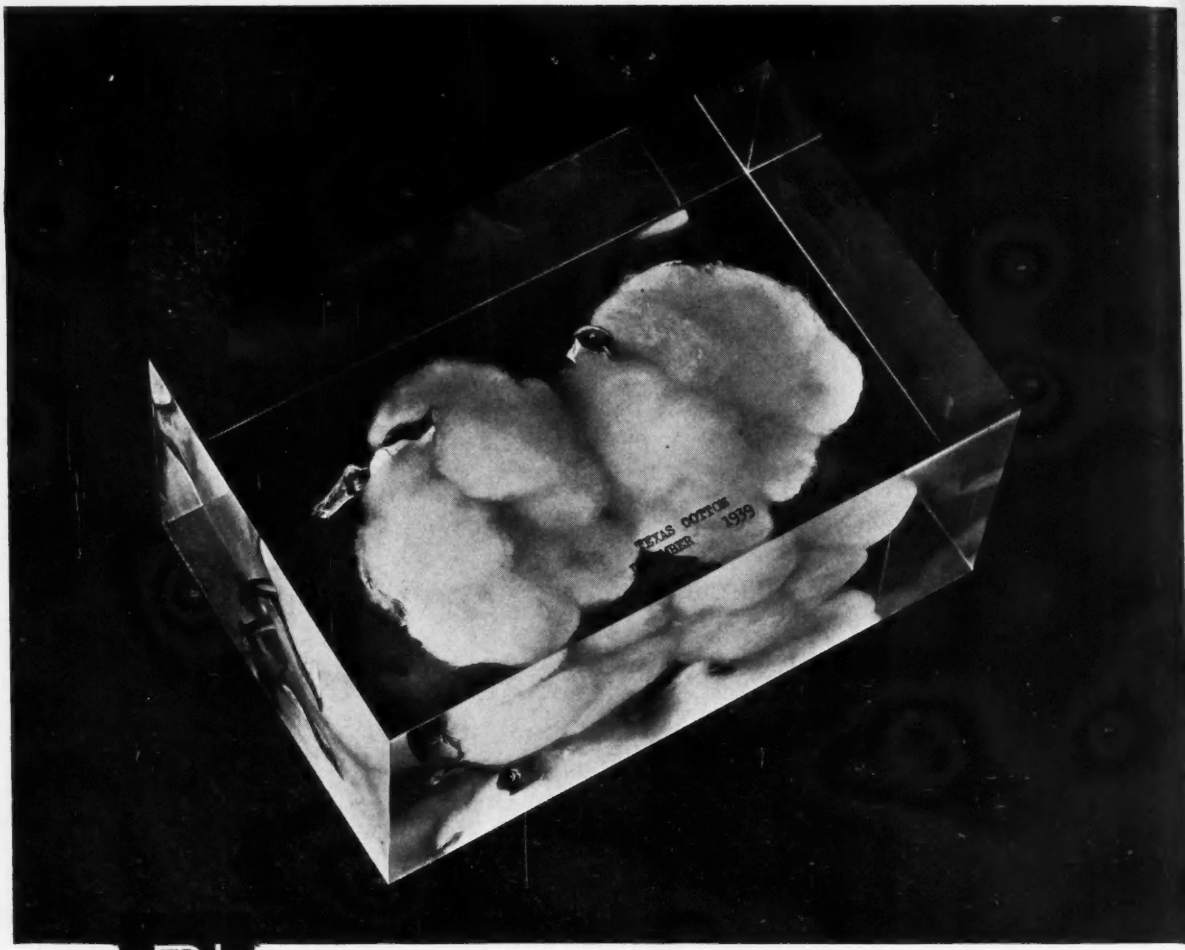

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VOLUME 29 JUNE 24, 1940 NUMBER 13

Development of

Aqueous Rubber Dispersions

and Their Application to Textiles

B. A. HAROLD

A GROUP of compounds, whose description has hardly appeared in textile literature, has been present upon the market for textile application for many years. We refer to rubber dispersions.

Textile firms who have been large users of rubber latex in past years have turned towards rubber dispersions as a substitute for latex. Since the advent of war in Europe, the basic price of rubber latex advanced tremendously, this increase reaching at one time to 60 per cent. The cost of rubber dispersions, on the other hand, remained within a narrow range and showed little fluctuations. Hence, they found favor as latex substitutes.

Much like latex, rubber dispersions are offered in two forms: (1) simple dispersions of crude or reclaimed rubber, or (2) as a blend so compounded as to yield very definite properties in the final films. In the following, we will describe the interesting methods that have been followed for preparing these dispersions.

In approaching the problem of producing a rubber dispersion, early investigators had much the same problem as that confronting an individual who was called upon to transform a hard boiled egg into a soft boiled one, i.e., "deboiling an egg." Thusly, rubber when tapped from the tree exudes as a colloidal dispersion. A coagulant separates the rubber from its dispersing medium. Therefore, it was necessary to find a way by which rubber could be redispersed into an aqueous medium; in other words, back to its original colloidal state.

Early rubber dispersions in this country were made by Pratt[1] in 1922. The rubber was dissolved in a solvent such as benzol, and oleic acid was added to this solution. An ammonia solution was then made and this was added to the rubber-solvent oleic mixture to form an ammonia soap around the rubber globules. After diluting with water, the solvent was then removed by evaporation or in a vacuum still at 50° C.

The main disadvantage of this process was the fact that inflammable solvents had to be used and it was costly to recover the solvent.

Pratt[2] improved upon this process by obviating the volatile solvent, and instead dispersed the rubber globules directly into water.

This process consisted of incorporating water with a water-carrying colloid such as glue, albumin, casein, gum arabic or starches into the mass of crude rubber on a mixing mill, and then dispersing the mass in water so as to produce a paste of desired constance. Upon subsequent dilution it was necessary to use some substance of soapy or lubricating nature such as saponin or soap bark extract in connection with the water in order to promote the slipping of one rubber globule upon another without adhesion. Pratt offered as an example of this procedure the following:

> "550 parts of coagulated crude rubber is placed on a rubber mixing mill, and the rubber milled until it becomes warm and plastic. To this is added 27½ parts of glue dispersed in a small amount of water. This mixture is then transferred to a two blade dough mixer and enough water is added to bring the total water content to 10 per cent. The mixer is covered and allowed to run until the rubber has absorbed all of the water.
>
> "A solution of one part of saponin to two parts of water is prepared and 82½ parts of this solution is added slowly to the mass in the mixer until a putty-like mixture results. This is finally diluted with 250 parts of water."

The above procedure can be altered so that the reclaimed rubber may be substituted for the smoked sheet, or compounding ingredients, such as, sulfur, zinc oxide, accelerators, anti-oxidants, whiting or clays may be added to the dough mixer to give definite properties to the final films.

In mixing early types of rubber dispersions, Trumbull[3] advocated the Baker-Perkins mixer, stating that by means of this mixer the rubber compounder was permitted to prepare rubber dispersions from a wide range of rubber compounds. This range even included compounds in

which pigments predominated, and rubber itself playing a relatively minor part. It also permitted to substitute the major part of rubber by reclaimed rubber without in any way preventing the process of dispersion. "Reclaim dispersions" as these batches are called, were claimed by Trumbull to be prepared in a shorter time, and with less uncertainty than raw rubber dispersions. Dispersions containing as high as 75 per cent by weight of total solids have been made which have good stability.

In analyzing the Pratt process for making rubber dispersions from a mechanical standpoint, the rubber mixing mill serves to disseminate the colloidal body into the rubber in a uniform and thorough manner. The dough mixer serves a different purpose as here the mass is constantly kneaded, pulled and stretched in the presence of water until the interfacial tension between the rubber globules is reduced to a minimum, whereupon the globules with the additional protective coating of saponin separate and disperse in the water.

It was Pratt's theory that if water could be introduced into a rubber mass so that by penetrating the interstices between the rubber globules, the functions of the protective coatings, which consist of certain saponins, resins, proteins, fatty acids and their esters, could be restored as well as reducing the interfacial tension of the globules. Thus, this would permit the restoration of the globules to their original shape, and allow them to separate from adjacent globules. Under these conditions, it would be possible for rubber globules to be dispersed in water to the same extent that they were dispersed in the original latex. When rubber latex is coagulated and the water is removed, certain water soluble substances remain with the rubber, and upon oxidation apparently increase in tensile strength, as they bind the rubber globules more tightly together. Conversely, when they are brought in contact with water again, this tensile strength is decreased, so that the mechanical adhesion is reduced. These water soluble substances then perform substantially the function of a lubricant while still acting as protective coatings for the terpene centers of the globules.

Admittedly, the above described Pratt process for preparing rubber dispersions is an interesting industrial application of the mechanical and chemical phases of colloidal chemistry.

In 1934, a process for preparing rubber dispersions was developed by Levin[4] which claimed certain advantages over the Pratt process. These were:

(1) Low power requirements for preparation of the dispersions.

(2) Less skill required in making.

(3) Dispersions made by this process are tackier and will carry higher percentages of fillers.

(4) Dispersions are far more compatible with electrolytes such as waterproofings.

The procedure followed in the Levin process is as follows:

"850 parts of reclaimed rubber are subjected to the plasticizing action of a mixer of the Banbury type, the plasticization being activated by 45 parts of a softener such as cumar resin or mineral rubber for twenty minutes. 160 parts of rosin soap are mixed with 100 parts of water and this mixture is added to 700 parts of whiting which has been pasted with 250 parts of water. The soap-whiting mixture is a blend possessing the consistency of heavy putty.

"This paste is placed in a kneading machine of the Werner-Pleider type, and the mass of plasticized rubber then added to it progressively. The mixer is continued in operation for 30 to 80 minutes with steam passing through the jackets of the mixer in order to maintain the contents at 180° F. Here the rubber disperses in the form of finely divided particles.

"If, during this operation, heat causes evaporation and undue thickening results, small quantities of water may be added to compensate for moisture loss. At this point, suspensions of vulcanizing ingredients may also be incorporated to produce definitely desired finishes."

The Levin process claims that when the plasticized rubber is added to a water paste of a colloid in a kneading machine, this operation is such that the colloidal paste is always in the continuous phase and the rubber is dispersed in this phase. In the Pratt process, on the other hand, the coherent rubber mass is maintained as the continuous phase, and much greater power is required to stretch and pull this heavy mass in order to cause the water of the dispersing agent to be absorbed.

Microscopically[3], rubber dispersions do not show particles of characteristic shapes, such as the pear shaped particles of rubber latex. However, it has been observed that the average particle size of a tire reclaim dispersion is fully as small as that of latex.

Rubber dispersions have found their major use in the textile industry, for application to rug and carpet floor coverings. Nelson[5] has described their use as a sizing for carpets, punched felt rug padding, and for pile fabrics where the dual purpose of locking the fibers in place and stiffening the product is accomplished in one operation. Many of the dispersions are so compounded as to allow them to be added directly to hat starch mixtures without danger of coagulation. The rubber serves to yield greater flexibility to the starch as well as cementing the fibers.

One type of rug which is not woven is held together by two rubber dispersions, one to saturate the backing and the other serves as a heavier coat on the backing into which the pile is pressed and cemented. Other uses for rubber dispersions include non-skid backing for rugs, for dipping fabric gloves and for producing tough, durable coatings on fabrics.

One disadvantage to films deposited from rubber dispersions is the fact that they do not possess the high tensile strengths that may be attained with those of properly compounded rubber latices. This has been shown by Fowler[6] in Table I.

(Concluded on page 332)

PROCEEDINGS OF THE
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JUNE 24, 1940

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• CALENDAR • OF COMING EVENTS

Annual Meeting and Convention, auspices New York Section, October 18th and 19th, 1940, Hotel Commodore, New York City.

Meeting, Piedmont Section, Carolina Hotel, Pinehurst, N. C., November 1 and 2, 1940.

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Physical Chemistry of the

Newer Detergent Processes*

DR. MALCOM DOLE**

FIRST of all, let us consider the chemical nature of soap solutions. As you all know, ordinary soaps are salts, metallic salts; or, as Hartley of the University of London has described them, they are paraffin chain salts[1]. Ordinary soaps, however, have certain undesirable chemical properties; that is, they hydrolyze in water, forming alkaline solutions, and in the presence of calcium ions, as you all know, a calcium soap precipitates. That destroys the detergent properties. Furthermore, hydrogen ions or acids precipitate the soaps and also destroy the detergent properties. We can overcome these chemical difficulties by changing the chemical nature of the soap. For this purpose we have available many new types of detergents. However, before describing their qualities or their properties, I want to go into the physical nature of ordinary soap solutions, because by understanding and studying ordinary soap solutions we can then have a good background to understand the physical chemistry of the newer detergents.

Now I think we can say that our knowledge of soap solutions, the knowledge of the physical chemistry of soap solutions, we owe very largely to McBain at Stanford University[2]. McBain measured the electrical conductivity of soap solutions and found that the conductivity was fairly high over the whole range of concentrations. He worked at 90° C. where he could get good concentration of the soap and found that the electrical conductivity of those solutions was about two-thirds of that of sodium acetate solutions; sodium acetate being the salt of acetic acid, of course, and being completely ionized, as we believe today.

After measuring the electrical conductivity, you might conclude, or McBain might have concluded, that soap represents a rather highly ionized salt, not as ionized as sodium acetate, but still highly ionized.

The next thing he did was to measure the so-called van't Hoff factor, i. which is related to the freezing point lowering of the solution, or boiling point elevation. You remember the van't Hoff factor, i, is equal to the boiling point elevation of the solution divided by the boiling point elevation that you would have for the ideal solution like a sugar solution.

McBain developed a rather clever apparatus for measuring this quantity. Soap solutions cannot be boiled because of the froth formed, and he could not get reliable freezing point measurements, so he measured the dew point. He placed a silver tube over a soap solution that was maintained in a water bath at 90° C. By running water a little cooler than 90° C. through the silver tube, he could find the temperature at which dew first began to form on the silver tube. From the difference in temperatures he could calculate the van't Hoff factor, i. The van't Hoff factor, i, is related to the degree of disassociation that you calculate from the conductivity by the relationship $i = 1 + \alpha$. The equation for α is $\alpha = \lambda / \lambda_0$ where λ is the equivalent conductivity of the solution and λ_0 is the equivalent conductivity at zero concentration.

The very remarkable results obtained when McBain measured the van't Hoff factor, i, are illustrated in Fig. 1,

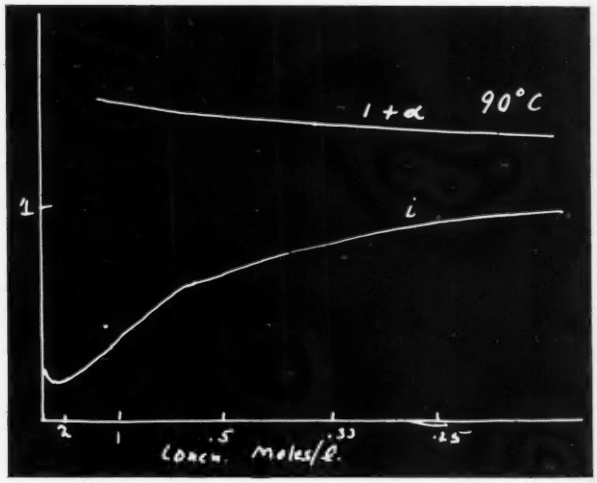


Fig. 1

where we have also plotted values of $1 + \alpha$. The factor, i, as determined from conductance, is much higher than 1. If the solute were sugar, i, would be nearly equal to unity at all concentrations. Ordinary salts, such as sodium acetate, have a value of i, always greater than 1 because they dissociate into two ions. But for soap solutions, McBain found that the value of i dropped much below unity, reached a minimum, and began to rise as the concentration increased, yet the electrical conductance was high. How can this be explained? How can you account for the fact if you determine the fraction of ionization from the dew

*Presented before Mid-West Section, March 22nd, 1940.

**Laboratory of Physical Chemistry, Northwestern University.

point elevation, data are obtained which are lower than those determined from conductance? There is a marked difference.

The answer is as follows: The soap molecules form in solution a sort of colloidal solution. We get as McBain called them the colloidal electrolytes; colloidal ions are formed. In other words, the fatty acid anion, in the case of sodium stearate, for example, which corresponds to 17 carbon atoms in a straight chain with hydrogens attached, and the carboxyl group at the end, becomes colloidal; that is, maybe 5, 10 or 20 of these negative ions come together to form a very large particle. This explains the drop in the curve for the van't Hoff factor, i.

But now, why does the electrical conductance still remain high if all these negative ions come together to form a large particle of colloidal dimensions? The answer is this:

They are not neutral particles that are agglomerating to form the colloidal electrolytes, they are ions. Even after they have agglomerated they can still conduct the electrical current. We do not have a neutral colloidal particle here. We have a very highly charged colloidal particle. And so, that is the most important characteristic, I think, of all soap solutions; and not only do ordinary soaps form colloidal electrolytes, but the new detergents, sulfonated and sulfated ethers and alcohols and acids, form colloidal electrolytes, too.

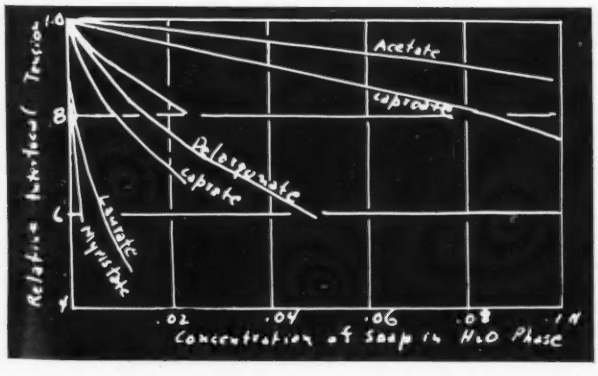
If you remember the last lecture here on the nature of dyes, and the physical chemistry of dye solutions, you will remember that we found dye ions to form colloidal electrolytes.

We can have negative colloidal ions, as in the case of the ordinary soaps, or they might be positive, as in the case of such soaps as cetyl pyridinium bromide. However, those soaps that have positive colloidal ions are not very useful because if they get mixed at all with ordinary soaps they will immediately precipitate. The large positive ion combines with the large negative ion and the whole thing flocculates.

Let us consider other physical properties of soap solutions. The density of soap solutions is interesting because in some cases the density is less than the density of either component[2]. Apparently the formation of these large colloidal particles must open up the structure of the water and make it less dense.

The most important property which we want to study is the surface tension of the soap solutions and the interfacial tension of soap solutions against oil. In Fig. 2, we have plotted interfacial tension measurements against concentration of soap for a number of sodium salts[2]. It is not until we come to the sodium salts of the long chain fatty acids that we find a very marked effect on the interfacial tension. With sodium acetate there is not much change of interfacial tension with concentration, but with sodium laurate there is an enormous effect.

Fig. 2



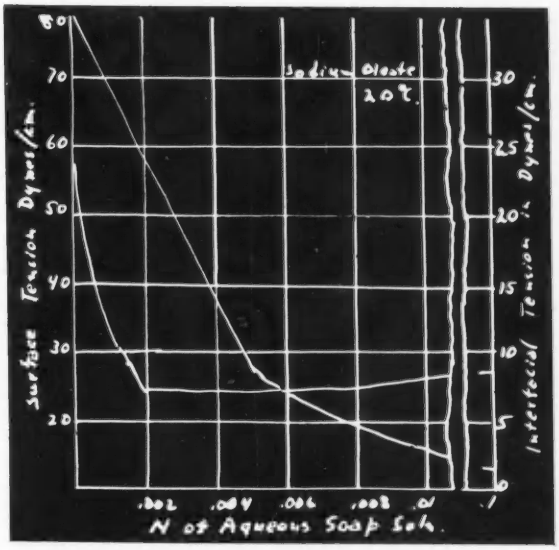


Fig. 3

In Fig. 3, we show the effect of sodium oleate, the sodium salt of an unsaturated fatty acid on the surface tension of water. For the interfacial tension against benzene[2], as the concentration of the soap increases, the interfacial tension drops way down to the very low value of about two dynes per centimeter, so these colloidal electrolytes have a tremendous effect on the surface tension and interfacial tension of water and of oil.

Why is it that these soaps have this pronounced effect on the interfacial tension and the surface tension? A possible explanation can be given in terms of the well known Gibbs' adsorption equation

$$d\gamma = -\Gamma\, d\mu \qquad (1)$$

$$\frac{d\gamma}{dc} = -\Gamma \frac{RT}{c} \qquad (2)$$

This equation (1), expressed in the most general form, says that the change in surface tension, $d\gamma$ is proportional to the negative of the surface adsorption, Γ, multiplied by the change in chemical potential; or the change in surface

tension divided by the change in concentration equals the adsorption multiplied by R, the gas content, and the absolute temperature divided by the concentration (Equation 2).

Γ is the excess concentration at the surface over that which the concentration at the surface would be if the concentration remained uniform right up to the surface; that is, if the concentration of the soap solution is absolutely uniform right up to the surface, then Γ would be zero and there would be no change of the surface tension with a change of concentration. But if Γ is positive, if the solute accumulates at the surface, then the slope of the surface tension concentration curve must be negative. This means that the surface tension will fall with rising concentration. And of course, that is what happens with the soap solutions. In case Γ is negative, we would have the solute repelled from the surface, and the surface tension would rise with rising concentration, which is the case for solutes like sugar and salts. All ordinary salts added to water raise the surface tension of water, but paraffin chain salts, like soaps, do just the opposite, because in the case of soaps there is a long hydrocarbon chain which is not soluble in the water, so that the water tends to push the soap out of the solution. The soap accumulates at the interface of the air-water boundary, or of the oil-water boundary, and thus lowers the surface, or the interfacial tensions.

So you should think then of soap solutions as containing on the surface an adsorbed layer containing many more molecules of soap than there are in the interior of the solution. This is also true for interfaces against oil where it is easy to predict that the hydrocarbon end of the soap will dissolve in the oil, and the polar end of the soap, that is, the water soluble end, the carboxylic end will be in the water. The soap in that case will be half in the water and half in the oil, so to speak.

Now part of the detergent properties of the soap depend upon its ability to form an emulsion with oil. And we would expect that the more rapidly or easier the soap can lower the interfacial tension, the more readily it can form an emulsion. This is true to a certain extent because when we form an emulsion, say, of oil in water, we increase the interfacial surface tremendously, and it is impossible to do this if the interfacial tension is high. If interfacial tension is lowered, it becomes easier to increase the interfacial surface and to make an emulsion.

Fig. 4 shows a contrasting situation for sodium soap and calcium soap[3]. Incidentally Fig., 4 illustrates the oriented wedge theory of emulsion formation, and I am presenting it to you simply because one finds the theory in the literature.

Here we supposedly have sodium soap with oil, the internal, and water, the external phase. These circles represent the polar and water soluble end of the long paraffin chain salt, and the light parts are supposed to represent the hydrocarbon chain. In this case they are

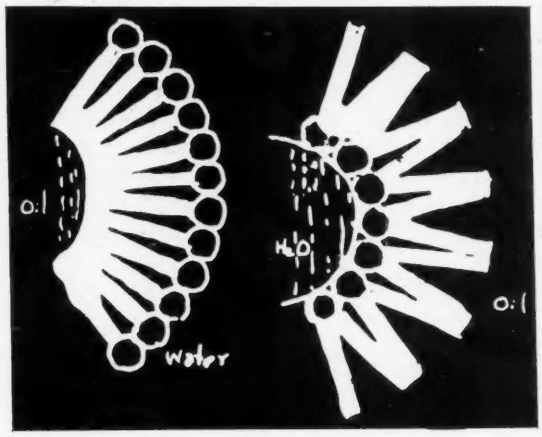


Fig. 4

pointed towards the oil, the oil particle forming the emulsion in the water.

On the other hand, the calcium soap has two hydrocarbon chains per calcium atom, and the emulsion is of the opposite type. It is an emulsion of the water in the oil. The people who believe in this oriented wedge theory claim that because of the two hydrocarbon chains per calcium atom, it would be impossible to fit them together in the same way that the sodium soap molecules fit, and so, the emulsion must turn around and be of the other type; water in the oil emulsion.

In other words, in the case of the calcium soaps the hydrocarbon surface must be convex because of its bulk; the sodium soap hydrocarbon surface can be concave. I think the chief objection to this theory is that the oil globules are not very small. This picture would make you think they were about the same size as a soap molecule, or a little bit larger. But actually the oil particles in an emulsion may be as much as 50 μ in diameter, which is very much larger than the diameter of a soap molecule[1]. The curvature does not seem to be sharp enough to make this explanation valid.

Furthermore, as we can see in Fig. 5, there is a very pronounced change of emulsifying power with a change in the concentration of the soap, the emulsifying power passing through a maximum at a concentration of 0.004 molar[2].

Now what is the theory for the formation of emulsions? First of all, it is necessary to subdivide the particles until they are small enough, and to cut down the interfacial tension in order to be able to maintain the emulsion, as I have already remarked. Some people think that these soaps form a sort of viscous film about the oil particle to give it a protective coating, thus serving as a protective colloid. But I am not so sure that this theory is valid, either. We know that these soaps, when adsorbed on the surface of the water, form what is known as gaseous films. Adam and Harkins and Langmuir, who make film pressure

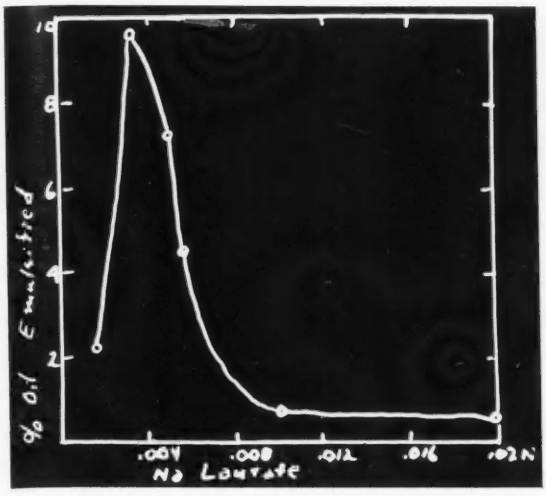


Fig. 5

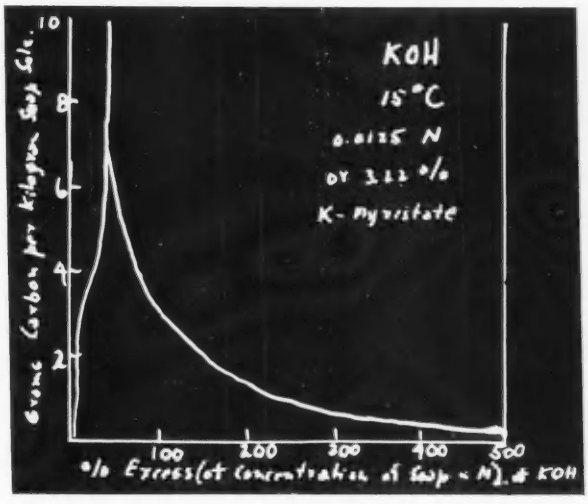


Fig. 7

experiments with the film balance, have studied soaps and have found, particularly Adam and McBain, that they are not solid films as exist with stearic acid, but because of the repulsive forces between the ionic ends of the molecules, the soaps form gaseous films[1]. For this reason I doubt if there could be formed about an oil particle a film that would be tough enough to serve as a protective colloid in the sense of giving the necessary mechanical protection.

In regard to the oriented wedge theory, silver salts act like calcium salts which is an argument against the oriented wedge theory, because silver soaps have only one hydrocarbon chain per silver atom.

In addition to the emulsifying power of soaps, we wish to study what we might call the solid suspending power, the power to suspend solids in the water. Whenever you wash something, you want the dirt to be detached from whatever you are washing; and once it is detached from the fabric or the hands, you want it to stay in the water. You don't want it to precipitate out again on the fabric.

Fig. 6 shows how sensitive the solid suspending power is to the soap concentration[2]. Here we have plotted grams of manganese dioxide per liter of suspension as a function of the concentration of sodium oleate in water. It is evident that the suspending power goes through a pronounced maximum at about .4 per cent of sodium oleate. I think that this effect will in general be true, at least for ordinary soaps.

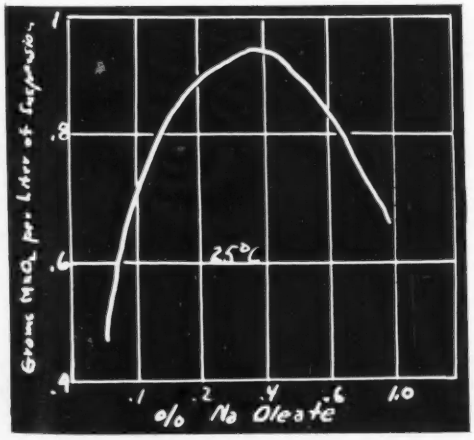


Fig. 6

Fig. 7 shows this even more emphatically. In this illustration we have plotted the grams of carbon suspended per kilogram of soap solution[2], as a function of the concentration of potassium hydroxide in excess of the soap concentration. Potassium myristate was the soap, which was .0125 normal. The data indicate that adding a little potassium hydroxide helps to suspend more carbon, but adding more potassium hydroxide makes it precipitate out again. So, here we have another example of how the solid suspending power of the soap solution depends upon the concentration.

Why is it that adding a bit of potassium hydroxide enables us to suspend more carbon in the soap solution, and adding too much makes the curve fall off again? Probably the carbon goes into solution as a colloidal particle, as the carbon will not dissolve in the water. Every colloid has its so-called double layer of charges; the Helmholtz double layer, if you wish, originated by Helmholtz many years ago. Today we know that it is probably a diffuse double layer of electric charges. And if you add a little salt, say, to an oil drop suspended in water, the charge increases the oil drop and makes it more stable because the stability of a colloidal particle depends upon its electric charge. If you have colloidal particles all charged alike, let us say with a negative charge, they repel each other, so that the colloidal suspension remains stable. But if you add ions to the solution that will neutralize the colloidal charge, then the particles no longer repel each other and they will agglomerate and precipitate.

If you take an oil drop in water or a piece of asbestos, or an air bubble, or a glass particle, or most any colloid you can think of, and add a little sodium chloride, the colloid becomes more stable, because a little sodium chloride in the water enables it to adsorb more negative ions. But if you keep on adding sodium chloride you get so much electrolyte in the solution that the colloid is discharged, the particles come together, as they are no longer repelled, and they precipitate.

This theory partly explains the data of Fig. 7. We add some KOH and the hydroxyl ions present enable the carbon particles to become charged even to a greater extent negatively, but as more potassium hydroxide is added, the electrical potential of the double layer declines and less carbon remains colloidal.

Now, what we all want to know, I think, is to what is detergency due? How are we going to explain the detergent property of soap solutions? I think the present point of view is this. Let us consider the dirt particle after we have it in the solution, thus starting with the dirt particle in the solution and explaining later how it got there. McBain believes that his colloidal electrolytes, his colloidal ions, are so big that they can take the dirt particle right inside of them, or stabilize the dirt particle in some way or another so that the dirt remains in colloidal solution.

I have recently noticed in the abstracts of the papers presented at the Cincinnati meeting of the American Chemical Society in April that McBain gave a paper there on the solubility of hydrocarbons like pentane, hexane, petroleum ether, diethyl ether, etc., in water, as a function of soap concentration. He finds that adding soap to water makes petroleum ether, for example, quite a bit more soluble in the water.

As I say, this information comes only from an abstract, but it follows along the general idea of soap solutions making the oil more soluble in the water and making the dirt particles more soluble in the water. We still have to know how or why the dirt particle can be suspended in the water, in the first place.

Adam at the University of London has made an excellent study of this problem[1]. I am going to give you now his idea of the detergent process. He states that detergency depends upon at least five different actions, and he lists them as follows:

First, the surface tension of the water must be lowered. This is quite important.

Second, the solid particle must be wetted by the water.

Third, the water must be able to penetrate into the capillary pores of the solid particle. Penetration of water is important, whether it is into the fabric or into dirt.

Fourth, the dispersion or the emulsification of the grease or other hydrophobic solids in the water. That is, after the soap solution has penetrated into the fabric, it is necessary to emulsify the grease that holds the dirt to the fabric; or, if it is just dirt without grease, it is necessary to disperse or deflocculate the dirt.

Fifth, and finally, comes the detachment of the grease from the fabric.

We have already discussed the effect of the soaps in lowering the surface tension of the water, as remarked above. It is due to the adsorption of the soap on the surface film of the water.

Concerning the wetting of the solid surface, what is the physical chemistry of this process? The wetting can be expressed mathematically by the equation

$$\text{Cos } \theta = \frac{W_{AS}}{\gamma_A} - 1 \qquad \text{(Equation 3)}$$

Where θ is the angle of contact between the water and the solid surface, γ_A is the surface tension of the aqueous solution, and W_{AS} is the work of adhesion or the work of tearing off one square centimeter of the water film from the solid. S stands for the solid and A stands for the water. The greater the adhesion force, the greater the force between the water and the solid, the greater will be cosine θ; and the smaller the surface tension of the water, the greater will be the cosine θ, or the smaller the contact angle. We want a zero contact angle if the water is going to wet the solid completely. If the contact angle is not zero, it means that the water will not spread over the solid readily. The contact angle of water on glass, for example, is zero. Water will run up a glass capillary tube, as you know, but if you put a drop of water on a greased film, the water will not spread on the grease because the contact angle there is not zero.

Now, we wish to lower the surface tension to make the cosine θ large and we can do that by adding soaps to the water because they cut down the surface tension. At the same time they undoubtedly increase the quantity, W_{AS}, the work of adhesion, because the soaps will be adsorbed by the solid particle, probably with the hydrocarbon end next to the solid and the water soluble part of the soap pointing outward towards the water, so after the soap particle has been adsorbed on the solid, then the water can run over the solid particle more readily.

Incidentally, while we are talking about wetting, I might point out that, as you all know, a great number of new wetting agents have been discovered and have been placed on the market. An interesting thing about wetting agents is that the water soluble group is usually introduced into the middle of the molecule rather than at the end, while with soaps it is usually at the end of the molecule. I think the reason for this can be explained as follows:

When a soap molecule, with the water soluble group at the end, is adsorbed on a solid particle, it lies down flat; at least as far as we can tell within the experimental error, which is pretty large. I don't know that any studies have been made on wetting agents, but my guess is that they will not lie down flat on the solid, and therefore, will be better wetting agents because the hydrophilic groups only will be exposed to the advancing water.

When you talk about the wetting power of a solution or solid, it makes a difference whether you talk about the

advancing contact angle or receding contact angle, because after you have taken the solid and wetted it with the soap solution, or with the solution that contains the wetting agent, and then drain the soap solution off again, the surface of the solid may have been changed by the adsorption of the soap particle or wetting agent molecule. In the rest of the discussion this evening, I am going to talk about the advancing contact angle; that is, the contact angle that exists when the solution first comes into contact with the solid.

For penetration, it is not the cosine θ, but the cosine θ times the surface tension that should be a maximum for maximum penetrating power. This follows according to the ordinary equation for the rise of water in the capillary tube. Referring to Eq. 3 for γ_A, Cos θ to be large, it is necessary that the surface tension, γ_A, of water be small in comparison to the work of adhesion. In other words, the force binding the water to the solids should be much larger than the force binding water to itself. The surface tension, you will recall, measures the force with which molecules bind themselves to each other on the water surface.

Now how about emulsification? What are the equations that enable us to express mathematically the physical chemistry of the emulsifying process?

Equation 4: $\gamma_{AB} = \gamma_A + \gamma_B - W_{AB}$

gives us the interfacial tension between water and oil γ_{AB}. A represents the water and B the oil. W_{AB} is the work of separating one square centimeter of oil surface from the water surface.

Equation 5: $\gamma_{AB} = \gamma_B - (W_{AB} - \gamma_A)$

is No. 4 rearranged to demonstrate that to make the interfacial tension as low as possible, it is necessary that $W_{AB} - \gamma_A$ should be as high, and this means that the adhesion between the water and the oil should be as large, or that the surface tension of the aqueous solution should be as low as possible.

From all our equations it is evident that we must have, in addition to the other conditions, a low surface tension of the aqueous solution.

Equation 6: $\gamma_{AS} = \gamma_S - (W_{AS} - \gamma_A)$

gives the similar conditions for suspending a solid. γ_{AS} is the interfacial tension between the aqueous solution and the solid particle, which is equal to the surface tension of the pure solid minus $W_{AS} - \gamma_A$, which represents the difference between the work required to separate one sq. cm. of the aqeuous solution from the solid and the surface tension of the aqueous solution.

Now Adam believes, and I believe quite rightly, that the best measure of the detergent power of any solution is given by the advancing contact angle θ_{AB}, the angle the oil and water interface makes with the solid particle. Suppose we have an oil film containing the dirt or grease which we wish to wash off a fiber. Adam has made some very beautiful microscopic pictures of this process. As the fiber is placed in a soap solution the oil film separates to give, first, patches of film, and later, the oil particles bunch themselves together into globules which still adhere to the fiber.

The angle the oil-water interface makes with the fiber is θ_{AB}, and as remarked above, it is the most precise measure of detergency. The cosine of the angle is given by

Equation 7: $$\text{Cos } \gamma_{AB} = \frac{W_{AS} - \gamma_A - (W_{BS} - \gamma_B)}{\gamma_{AB}}$$

Cosine θ_{AB} should be as large as possible so the interfacial tension and the surface tension of the aqueous solution should be as small as possible. This is in agreement with our previous conclusions.

Unfortunately when a new detergent is invented, most of the quantities in Eq. 7 are unknown so that the only way to find out what the contact angle is, is to measure it by a rough optical method. There is a very good measured correlation between the contact angle and the detergent power, the cleansing power of the particular solution.

The microscopic pictures show that what happens first is that the oil film breaks up, or that the aqueous solution gets in under it and makes it separate and break up, and then the oil coalesces to little globules which will not come off the fiber unless the fiber is shaken. This is why in cleansing operations it is necessary to agitate the material being washed.

The detergency power of different detergents depends upon the substance that is going to be cleansed as well as on the properties of the aqueous solution. For example, detergent solutions which have about equal cleansing power on cotton will have quite different cleansing power on wool. This fact is contained in Eq. 7 because W_{AS} is the work of separating one sq, cm. of aqueous solution from the solid particle, and W_{BS} is the work of separating one sq. cm. of oil from the solid particle. If the solid particle is made of different material, these quantities will naturally be different, giving rise to a different contact angle and a different detergent power.

An important point is the extent of adsorption of the soap by the solid that is being cleansed. You do not want the fabric to adsorb the soap. In the first place, it will remove the soap particle from the soap and lower the soap concentration of the cleansing bath, and second, the detergent may weaken the fiber of the fabric, and in the case of the newer detergents, which are made from sulfates, sulfuric acid is formed by hydrolysis, not a desirable consequence. Sometimes the fabric adsorbs the soap so much that the cleansing operation will depend upon the length of time that the cloth is in the bath. For example, if the concentrations are just right, you can put a piece of fabric in for a half minute and it will be very clean, but if you leave it in for a half hour. it will come out dirty, because there is enough soap in the solution to take the dirt off the fabric in the first half minute, but as the soap as adsorbed by the fabric, the solution no longer becomes able to hold the dirt in suspension, so the dirt coagulates, settling out on the fabric again.

Now, soap and the newer detergents are adsorbed to just about the same extent on cotton but there is a marked difference on wool. Soap is adsorbed quite a bit more on wool than are some of the newer detergents.

Finally, I wish to show you some slides comparing some of the newer type detergents in regard to their properties[4].

First of all, I might say something about the chemical properties. I have already mentioned the fact that ordinary soap hydrolyzes and reacts with acid to form an insoluble stearic acid or other insoluble fatty acids, and reacts with calcium ions and magnesium ions, and so on, to make insoluble soaps. Today we have sulfated and sulfonated alcohols, esters and ethers, the new detergents. Of these the ethers are most stable chemically. Esters are hydrolyzed in alkaline baths, and sulfated alcohols decompose in acid baths. (Sulfonated alcohols, on the other hand, do not hydrolyze even on boiling.)

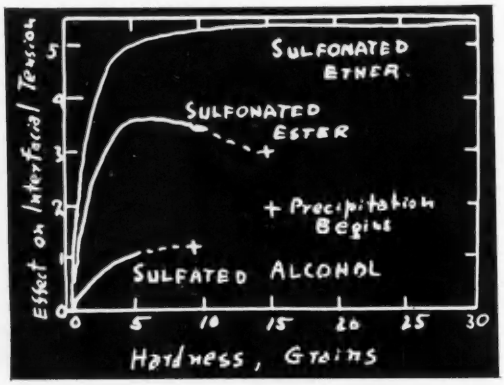


Fig. 8

Fig. 8 illustrates the effect of hardness of the water on the change in interfacial tension between oil and solutions of a sulfonated ether, sulfonated ester, and sulfated alcohol. Note that increasing the hardness of the water intensifies the effect. In other words, the detergents have a greater influence on the interfacial tension if the water is slightly hard than if it is not hard. But note that the sulfonated ester goes through a maximum, and at the point X, precipitation begins. The sulfonated ether is not susceptible to precipitation.

Fig. 9 demonstrates the carbon suspending power expressed in milligrams of carbon per hundred c.c.'s of solution as the function of concentration in per cent of a sulfated alcohol, ordinary soap, sulfonated ester and sulfated ether. Solutions of the ether are superior in their power of keeping carbon in suspension, and sulfated alcohol is the poorest of all.

TABLE I

Sample No.	*0.5% Soda Ash plus Following Detergent %*	*Grease Remaining in 10 gr. skein gr.*
1	0.25 soap	0.039
2	0.25 sulfonated ether paste	.027
3	0.08 sulfonated ether paste	.040
4	0.25 sulfated alcohol	.075

Table I contains some data showing the detergent powers of these different substances, determined in the following way: Ordinary wool was shaken with these washing solutions under definite conditions, and then the grease remaining in the skin was extracted with ether and weighed afterwards, and you see that .08 per cent of sulfonated ether is just about as good as .25 per cent of soap. About the same amount of grease was removed. In other words, one-third the quantity of sulfonated ether accomplished the same result as the soap.

We do not wish the fabric to adsorb the detergent because in the case of sulfated alcohols you may have hydrolysis later on, producing sulfuric acid, which is undesirable. The tests, illustrated in Fig. 10, are supposed to determine the amount of adsorption by measuring the concentration of the soap solution required to form a stable foam.

I am not sure that this is a very exact measure of the amount of detergent adsorbed, but at any rate it shows

Fig. 9

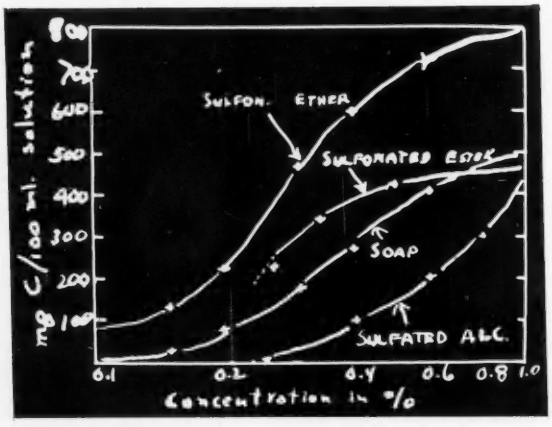
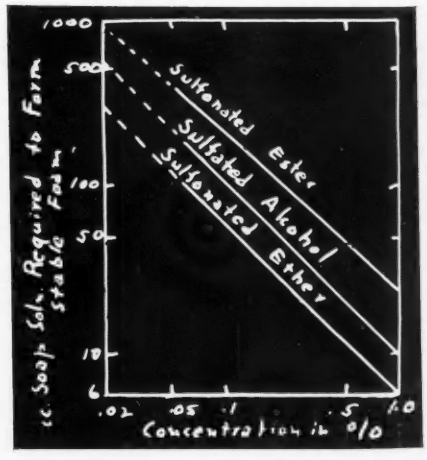


Fig. 10



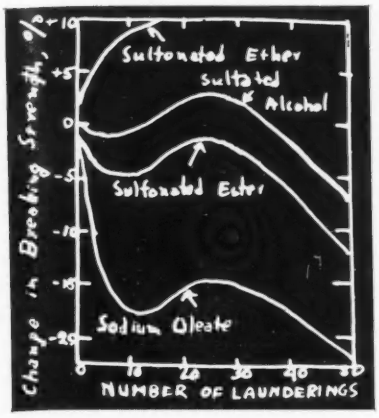


Fig. 11

that less of the sulfonated ether is required to form a stable foam than of the other detergents.

The last illustration, Fig. 11, shows the change of breaking strength with number of launderings.

All these detergents, or practically all, weaken the fabric because they are adsorbed into the fabric, lubricating it so that it becomes weaker. But the results for the sulfonated ether indicate that the fabric is actually made stronger. We probably have merely a realignment of fibers in this case.

I believe that is all I have to say. I would be glad to answer questions now if there are any.

DISCUSSION

Question: Dr. Dole, for these last four illustrations you gave, I think there should be some word of explanation because you heard groans from some of the men selling sulfated alcohols here. I happened to have had some experience with the sulfonated ethers in a practical way, and although sulfonated ethers are good wetting agents, as far as detergency is concerned, they do not compare with the sulfated alcohols. I mean in a practical manner. It seems to go back to one thing. That is this: There are a lot of wetting agents on the market—that is, for wool—that prove to be excellent wetting agents, but pretty poor detergents.

Dr. Dole: Yes, I took the figures from an article that appeared in "Industrial and Engineering Chemistry." I could not find out from the article whether they had used wool or cotton, or what they had used.

Chairman Boxser: They had pictures showing raw scoured wools, but that work appeared to have definite limitations.

Question: Dr. Dole, it seems to me there is a tendency to confuse detergency with emulsification. Undoubtedly they are related, but I doubt very much if they are the same thing.

Dr. Dole: Yes. I will speak on that point for a minute. There is no direct connection between lowering of interfacial tension and detergency. You can show it in this way. Adding hydroxyl ions raises the surface tension, but at the same time it increases the detergent action. The two salts, cetyl sodium sulfate and cetane sodium sulfonate, have exactly the same effect on the interfacial tension, but the sulfate is twice as good detergent as sulfonate. If you add sodium chloride to solutions of Igepon T, the interfacial tension is lowered one to six dynes, but the detergent properties are not altered. In the case of certain detergents, you will find the detergent properties on cotton and wool to be different.

I think the explanation comes from Eq. 7, which is the best known expression for the exact measure of detergency. The only trouble is that it contains factors that are rather difficult to evaluate. You can evaluate them if you want to go to the trouble to set up the optical system to make measurements of the contact angle. The interfacial tension enters into Eq. 7, but it is not the whole story.

Question: Dr. Dole, you said before that for the wetting properties of the substance you would put the solubilizing group in the center of the chain. Did you have in mind Aerosol OT Dry? If that is the agent, I would question the orientation of the solubilizing group.

Dr. Dole: Yes, according to my colleague, Prof. Suter, it is usually true that in making a wetting agent, the polar group is substituted in the middle of the molecule, and to make a detergent it is substituted on the end. There may be some exceptions to the rule.

Question: I think so. I would like to learn more about that rule, because all the compounds that I know of that are good wetting agents are not considered good detergents. Those long chains might be associated and they might be only one chain.

Dr. Dole: I understand that. But that is one reason why, I think, Aerosol OT Dry may stand up straight with the water soluble group pointing out, instead of lying down flat. In this case it would be a better wetting agent.

Question: I thought all those compounds lie vertical. That was my understanding all the time.

Dr. Dole: No, according to the film pressure measurements, these are gaseous films and not like stearic acid, which is a solid film on the surface of the water.

Question: Then you would say sulfonated oils should be very good wetting agents, like sulfonated oleic acids, esters, or any one of those, which are practically sulfonated in the center. You would expect a thing like that to be quite a good wetting agent?

Dr. Dole: Is it?

Member: No, very poor.

Dr. Dole: The wetting power depends upon W_{AS}. If you know what the work of adsorption of the aqueous solution on the solid is you can calculate the contact angle.

Question: I was remarking about the orientation. There you have it right in the center. You can put in two groups on the double bond and you will have a similar case to this compound that you just wrote out.

Dr. Dole: But your water soluble part must be pointing outwards.

Chairman Boxser: I think someone ought to get up in the defense of soap.

Member: Soap needs no defense.

Question: Dr. Dole, you mentioned sodium oleate and the suspension of pigment. When you referred to sodium oleate you said that was true of all soaps. If you made sodium oleate out of 1 titer red or out of 20 titer red oil, wouldn't you find a difference in your results on your suspension of pigments?

Dr. Dole: The illustration referred to just pure sodium oleate solutions. What you would have when you try mixtures, I don't know. Undoubtedly, commercial preparations would not be pure compositions.

Member: The commercial preparation would be somewhere around 10 to 12 titer. Titer is the melting point of the fat. I do not think there is anybody making sodium oleate with zero titer. And of course, on that commercial test, as I understand it, it is pretty well conceded the higher up you go in titer, the more suspension, because your solubility decreases. Now I was just wondering what you referred to?

Dr. Dole: When you have mixtures of different soaps, then the situation is different. McBain has done some work on mixtures of sodium palmitate and sodium laurate and the results are not what you would predict on the basis of a 50-50 mixture. The smaller molecule, which is the laurate, seems to displace the palmitate. It would be adsorbed in preference to the larger, and so, I would hate to say what you would have in the case of a mixture.

Question: Dr. Dole, I had one other question. I could be wrong, but as I recall, about the fifth from the last slide was one showing three different type materials, sulfonated ether, sulfated alcohol and sulfonated ester. I noted that certain of those were precipitated at relatively low concentrations.

Dr. Dole: Of hardness. I do not know whether that is low or not.

Acknowledgment

The author wishes to express his gratitude for many helpful discussions regarding detergency with his colleague, Professor Suter of Northwestern University.

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[1]N. K. Adam, J. Soc. Dyers Colourists—53, 121 (1937).
[2]A. W. Thomas, "Colloid Chemistry," McGraw-Hill Book Co., N. Y., 1934, Chapter XIV.
[3]Ref. (2), Chapter XVI.
[4]F. J. Van Antwerpen, Ind. Eng. Chem.—31, 64 (1939). Information received from various sources indicates that the sulfonated ethers are not as good in actual practice as this paper claims.

The Consumer Movement

and the Textile Industry*

F. S. BLANCHARD

I APPRECIATE very much the opportunity of being here tonight. I have been looking forward to this with a good deal more pleasure than I looked forward to the last talk I delivered in Andover—eighteen years ago—to the Massachusetts Clerical Association. Not that I didn't like my audience then as I do now. But I didn't like the subject of my talk. We were in the midst of one of the big strikes with which Lawrence was frequently afflicted, and the Clerical Association had asked my boss, Edwin Farnham Greene, then head of Pacific Mills, if he would take part in a joint debate on the merits of the strike with Francis O. Gorman of the United Textile Workers. Mr. Greene had asked if I thought he should accept. As public opinion, in the last analysis, usually settles strikes and as the members of the Clerical Association had an important part in the influencing of public opinion, I advised Mr. Greene to accept. It is very easy to advise someone else to stick his neck out. A few days before the debate Mr. Greene found that he had to go away on a business trip and suggested, with a rather poorly concealed grin, that I take his place. When I started my part of the debate I had the feeling that perhaps 2 per cent of the audience were on my side, and when I finished it might possibly have been 2½ per cent —though Mr. Gorman spent more time demolishing the pretensions of a rival union than he did on my arguments.

I am glad to say that my subject tonight is less controversial. In fact it is no more controversial than the question of whether the London office boy could take a day off to go to the big football match. On the morning

*Presented at meeting, Northern New England Section, April 11, 1940.

of the big match Tommy asked the boss if he could see him for a few minutes. He was greeted with an understanding grin and led into the inner sanctum. "Well, Tommy," said the boss, "I think I know what you are here for. You have come to ask permission to go to the football game." "Oh! no," said Tommy, "I am going to the game. I came to ask you if I might come back afterwards."

I hope that I'll find when I finish that over 2½ per cent of you are interested in what I think the textile industry should do to meet the Consumer Movement half way, and that I'll be invited to come back afterwards.

You men are on the firing line. You are interested, in many important capacities, in the production and finishing of textiles. You have been hearing a good deal lately about standards—for example, standards representing different degrees of color fastness. You have watched these standards rise higher and higher, and you have seen hundreds of millions of yards go out on the market constantly improving in quality as the years go by. By the nature of your training and your jobs, you are scientifically minded. You like to use exact definitions to express your standards. You know, for example, that there is no such thing as an absolutely fast color, and that color fastness is a matter of degree. You express those degrees in Fade-Ometer hours, or in water temperature and in other precise ways. You are not satisfied when someone talks loosely of fast colors. You immediately ask these questions:—Fast to what?—and How Fast?

I have said that you were on the firing line, for you are producers. You are also on the receiving line—or at least your wives are—for you, and they are consumers. You can imagine the bewilderment of the consumer when she is faced with a barrage of such terms as "tub fast," "boil fast," "vat dyes," "sun fast," "fast to washing" and "guaranteed fast colors." And when she finds that what one firm calls guaranteed fast colors fades badly in the sunlight and is no better than a fabric containing what another firm calls fast to washing colors, she begins to want to swat someone. And often she does an even more effective thing. She complains to the consumer standards committee or to the informative labeling committee of her club and sometimes these committees complain to the Federal Trade Commission. They are doing so now. If it were not for the fact that the National Association of Finishers of Textile Fabrics and your Association, in cooperation with other important interested groups in the trade, had already taken action to meet the above situation, we should undoubtedly already have heard very forcibly from the Federal Trade Commission.

You are undoubtedly familiar with what has been done to establish improved standards of color fastness and know that these standards have already been placed before the National Bureau of Standards at Washington and will shortly be issued as revised commercial standards. Some of your members cooperated directly in this important constructive step as members of the technical committee of the Finishers Association which recommended these standards. As you know, the standards went forward with the following endorsements:

American Institute of Laundering, Better Fabrics Testing Bureau, Calco Chemical Company, The Ciba Company, E. I. du Pont de Nemours & Company, Inc., Gustavus J. Esselen, Inc., Franklin Process Company, General Dyestuff Corporation, Good Housekeeping Institute, Industrial By-Products and Research Corporation, Lever Brothers Company, Arthur D. Little, Inc., R. H. Macy Bureau of Standards, Montgomery Ward & Company Laboratory, National Aniline & Chemical Company, Pease Laboratories, J. C. Penney & Company Laboratory, Sears Roebuck & Company Laboratory and United States Testing Co.

This is an impressive list. What is still more impressive is that our industry did not wait to be forced by governmental action to undertake a necessary reform, as happened too often in the past, but took the leadership themselves.

As you know, the fact that standards are issued by the Bureau of Standards does not make them compulsory or carry any enforcement. However, the Federal Trade Commission on receipt of complaints from an industrial association, a consumer organization, a company, or I believe, even individual consumers, may call a hearing and prescribe rules and terminology under which words connoting color fastness may be used. In other words they cannot make a mill say a fabric is color fast, but they can prohibit the use of any such terms in connection with it except in accordance with a certain prescribed terminology based on certain definite standards and tests. The job of setting up color fastness standards for cottons and linens has already been done by the industry as I said above. The next job is the determination of how to describe and symbolize those standards in terms that the public can understand, and how to bring about their widespread use. This job is now under consideration by the Finishers Association, who plan to obtain the co-operation of all interested branches of the industry. It is as difficult a job as the first one and will require a thorough survey of the subject. The survey must not only set up suggested terms to express the standards adopted, but must suggest a means of getting those terms and standards used, either by a comprehensive advertising campaign or through the enforcement by the Federal Trade Commission.

Why do we need to go to all this trouble? I have already referred to the confusion in the minds of the consumers in the face of all sorts of meaningless phases about color fastness. But I should like to discuss the whole question of standards in its broader aspects—not only as it relates to color fastness but in its relation to what the consumer wants to know about textiles. This brings me to the principal subject of my talk—the Consumer Movement and the Textile Industry.

What is the Consumer Movement and what does it

mean to us? The Consumer Movement is the name frequently given to the organization of groups of consumers to advance or protect their interests as consumers. Sometimes it is used to describe a changed and more aggressive attitude on the part of many consumers. We have been familiar for some time with the organization of employers into associations and of employees into trade unions. It is only recently that organizations of consumers have become vocal and really made themselves felt.

My first contact with the changing attitude of consumers came when I was a Deputy Administrator under the N.R.A. and had to worry about the textile codes for about six months. For the first time the government gave distinct and important recognition to the consumer point of view when it set up the Consumer Advisory Board of the N.R.A. While this board did not carry the influence of the Labor Advisory and the Industrial Advisory Boards, or swing a big stick at times, it did persistently bring the interests of the consumer before the Deputy Administrators in the making of all codes. This interest it kept expressing in terms of the consumers' desire for standards of product and for more information about what they buy—as well as their obvious desires to protect themselves against fraud and misrepresentation.

Since the N.R.A. days the Consumer Movement has become exceedingly vocal. On its conservative side it contents itself largely with an insistence on product standards, honest advertising and informative labeling. On its radical side it sometimes attacks all advertising and inveighs against the capitalistic system. As Professor Kenneth Dameron of Ohio State University pointed out in an article in the *Harvard Business Review*, "The Consumer Movement is a product of economic evolution. It is an aspect of the transition from a producer's economy to a consumer economy; from an economy of scarcity to one of plenty; and, with certain limitations, from a seller's market to a buyer's market. These changes have tended to make consumers more critical and to enhance their importance." Dameron points out that approximately 25,000 secondary schools offer some form of consumer education to 6,500,000 pupils, of whom at least 4,000,000 are girls. Books like "Your Money's Worth" by Stuart Chase and F. J. Schlink, published in 1927 and "100,000,000 Guinea Pigs" by Schlink and Kallet, have played an important part in arousing many consumers. Consumer buying guides and services such as "Consumers Research" and the "Consumers' Union" have had considerable influence. On all sides consumers are being urged to more intelligent buying, and are being educated to insist on more facts about what they buy.

Leading women's clubs and associations have committees dealing with such questions as consumer education, the promotion of informative labeling, etc. The American Association of University Women, with 63,000 members, the American Home Economics Association with 12,000 teachers influencing many more thousands of children and the General Federation of Women's Clubs with 2,000,000 members are among the most influential. In February, 1938, the formation of the Institute for Consumer Education at Stephens College, Columbia, Missouri, was announced. This organization is financed by the Alfred P. Sloan Foundation and has already held several important conferences to which leaders of consumer groups have come from all over the country. The Association of National Advertisers in a study of the Consumer Movement lists over eighty organizations interested in consumer education in one way or the other—with memberships totalling many millions.

The government has become increasingly interested in the consumers and consumer lobbies have become very active. Perhaps I should reverse the order of the sentence. Laws to protect consumers are going on to the statute books of many states as well as those of the Federal government. The Wheeler-Lea Act has extended the powers of the Federal Trade Commission to prevent business practice injurious to consumers. There has been considerable agitation for setting up a Federal Department, headed by a cabinet officer, to look after the interests of consumers.

In 1938 the National Consumer-Retailer Council began to function actively. This organization was formed to coordinate the activities of leading consumer and retailer groups in promoting their mutual interests. Its membership includes important leading women's groups, such as those already mentioned and also the National Retail Dry Goods Association, the American Retail Federation, the National Association of Better Business Bureaus, etc. Its officers include some of the most influential men and women in the Consumer Movement. The membership of its cooperating associations includes thousands of prominent women throughout the country. Its published objectives are representative of the objectives of the more conservative branch of the Consumer Movement. These are as follows:

(1) To stimulate interest in the value of adequate standards for consumer goods and to promote the use of such standards;

(2) To promote use of informative labeling;

(3) To promote use of uniform terminology in describing consumer goods and services;

(4) To promote truthful and informative local and national advertising;

(5) To promote informative salesmanship;

(6) To develop and promote use of suggested codes of ethics for retailers and consumers;

(7) To encourage practices which will tend to reduce abuses of such privileges as customer accounts, returned goods, deliveries, comparative pricing, etc.;

(8) To foster cooperation between stores, or groups of stores, and local consumer groups.

The stores are very much aware of what the Consumer Movement means to them. Some of the larger ones, for example, R. H. Macy, have set up testing laboratories. Many of the smaller stores shrink at the cost of

this and even the large stores find it difficult to test all they buy. For a number of years I have made a habit of visiting numerous stores, large and small, every year, wandering around and asking questions. On my last trip I was impressed by the number of buyers—particularly in various ready-to-wear departments—who told me that consumers were asking many more questions about the fabrics in the garments they bought than they had asked in the past. This was reflected in a changed store attitude towards garment hang tickets. Many stores who formerly removed all garment hang tags are now leaving them on, provided the tags are truly informative.

What does all of this mean to us? It means a number of things. In the first place it means that we shall have to produce goods to more definite standards than in the past and we shall be required to define those standards more accurately in accordance with prescribed terms. We have already seen this happen in the case of shrinkage and in the fiber content of rayon goods. We shall see it happen in color fastness, crease-resistance and in many other ways. At the present time we are not required by law to give approximate percentages of fiber content of mixed goods. For example, fabrics containing 55 per cent rayon and 45 per cent wool, and fabrics containing 90 per cent rayon and 10 per cent wool would both be described as rayon and wool fabrics—the fiber of the largest percentage coming first in both cases. It seems very probable that more precise definitions of fiber content will ultimately be required. You are undoubtedly familiar with the battle that is now being fought over virgin vs. reworked wool. One of the most active of the consumer leaders who has fought and bled over virgin wool asked me to do a much more difficult job:—help her to answer a very convincing letter from Dean Walen, which had pointed out the disadvantages and difficulties of attempting to distinguish between virgin and other wool in a fabric. I tried to convert her to the viewpoint held by Mr. Walen, and by the majority of the industry, but without success.

Sometimes we shall be asked to do some very impractical things, to give information which would be more confusing than helpful to the consumer. For example, to take a garment hang tag as an illustration, I recently went through a number of reports, articles and speeches by consumer leaders, and I listed a few of the items which one consumer or another asked for in connection with fabrics for garments:

Weight of fabric.
Threads per inch, warp and filling.
Breaking strength (whether strip or grab method).
Raw materials of which it is composed—per cent of each.
Color fastness to laundering, dry-cleaning, sunlight, perspiration.
Shrinkage in percent.
Resistance to yarn slippage.
Resistance to creasing.
Air permeability.
Heat transmission.
Washing instructions—in detail.
Conditions of labor under which it is made.
Name and address of producer.

I realize that all of the speakers or writers were not thinking of the same type of garment, but this does illustrate the impracticability of some of their ideas. To put all of this on a garment hang tag would require a tag which would pretty well conceal the garment and be as large as a page of the *New York Times*.

The National Consumer-Retailer Council recently made a consumer survey to determine what consumers and stores most wanted to know about various kinds of products, including several classes of textiles. Questionnaires listing almost every conceivable thing that a consumer might want to know about each of a number of lines of product were sent to about 2,000 consumers, 1,000 retailers and 1,000 manufacturers—representatives of the groups which were members of the Council or manufacturers of the products listed. Replies were received from about 20 per cent. While of course many of those replying checked nearly all of the items listed, an indication of the attitude of the above groups is obtained by analyzing the items considered as most important and which obtained the highest percentage of check marks. These are shown in the table at the top of the next page, for several leading textile products (omitting items relating to the garment only and not to the fabric).

The items shown are not all that are listed, but they are the items considered most important. It is interesting to note that among all groups color fastness—to washing and light—received a high rating, as did detailed handling instructions. Content is considered of high importance by consumers, and by stores for wash dresses, but not by manufacturers. While the groups to which these questionnaires were sent are undoubtedly above the average in intelligence and education, other surveys seem to confirm the above.

My company, the Pacific Mills, recently had a survey conducted among 1,000 consumers in different income price brackets to determine whether the proposed new Pacific "factags" contained information which was what the consumers wanted and which was understandable to them. The new tags contain information on color fastness to washing and to light (based on the standards recently submitted to the National Bureau of Standards), fiber content, handling instructions, and the special features of the fabric (such as enduring crinkle—not permanent crinkle). Ninety-seven per cent of the consumers interviewed said that they considered these tags contained all of the information which they considered essential. Eighty-eight per cent did not want to eliminate any of the information given. We were concerned here with tags for women's garments. The information required would

	Women's Wash Dresses			Men's Shirts		
	Consumers	*Stores*	*Mfrs.*	*Consumers*	*Stores*	*Mfrs.*
Color fastness to washing	94.4	89.0	87.5	90.7	73.1	40.0
Color fastness to light	94.0	69.2	75.0	85.7	50.5	20.0
Fiber content, per cent by weight	90.0	74.7	50.0	84.6	38.7	...
Shrinkage or stretchage	89.5	69.2	62.5	88.6*	72.0*	60.0*
Fastness to perspiration	87.9	65.9	50.0	86.7	43.0	20.0
Detailed handling instructions	87.0	20.2	87.5	82.4	67.7	80.0
Weighting or sizing	82.3	20.9	12.5	75.3	21.5	...
Special finishes	79.5	31.9	62.5	69.8	32.3	40.0
Sponsor—Name and address	62.8	20.9	25.0	63.4	25.8	20.0
Name of fabric	...	...	...	76.7	63.4	80.0

*Collar.

Figures, in per cent, of those who consider item of major importance.

have been very different, of course, if the product were sheets or towels.

Broadly speaking, what the consumer wants to know may be summed up as follows:—

1. What is the product made of?
2. What will the product do, or perform?
3. How should it be cared for,—washed—handled—etc.?

Those are reasonable requests. Despite the impractical demands of some members of consumer groups, the Consumer Movement is based on a real need. Some advertising men and heads of businesses who have built up their company brands by many years of advertising view with great alarm the increasing demands of consumers. This is perfectly natural, for when a brand has acquired great popular good-will its owners do not like to see cold-blooded facts put it on the same apparent basis as an unbranded or less known product which has not stood the test of time. Still less do these men like it when they face attacks on all advertising, hear criticism of the whole capitalistic system, and face demands for all kinds of impracticable information. Like all forward movements the Consumer Movement has its "lunatic fringe," to use a favorite expression of Theodore Roosevelt's. But this should not blind any of us to the overwhelming preponderance of consumers who want to know more about what they are getting, and what it will do.

There are three ways of dealing with the Consumer Movement:

1. Ignore it.
2. Fight it.
3. Cooperate with it and endeavor to guide it along sound lines.

The last of these three methods seems to be the most intelligent. For, whether we like it or not, all signs point towards its becoming stronger and stronger. And besides, much of the power behind the Consumer Movement comes from a very natural and justifiable desire—the desire of consumers to buy more intelligently.

DISCUSSION

Q. What indications are there that this will spread to the woolen and worsted industry?

A. I was visiting with a number of buyers who were of the opinion that if they had informative labels they could have sold many more garments.

Q. How do the retailers feel toward this movement?

A. Within the last two or three years the stores would like to have informative labels, but it is the cutters who do not want to be bothered.

CORRECTIONS

IN the article entitled "Textone" which appeared on May 27th, 1940, A. L. Dubeau should have been named as co-author of the paper with G. P. Vincent.

In the report of the one hundred and twentieth meeting of the research committee, also appearing in the May 27th issue, the last sentence in the next to the last paragraph should read "For rubbing tests on yarns there was shown, etc.," instead of "For rubber tests on yarns there was shown, etc."

MEETING, NEW YORK SECTION

THE sixth meeting of the New York Section was held on April 26th, 1940, at the Swiss Chalet, Rochelle Park, N. J. The speakers were: Dr. M. C. Teague, Director, New Products Dept., U. S. Rubber Co., who spoke on "Some Recent Fiber-Latex Developments," and W. F. Uhlig, President, Color Analysts, Inc., who demonstrated the "Analyte." It was the consensus of those present at the meeting that the above paper and equipment demonstration were most interesting.

For the coming election of officers of the New York Section, Chairman Zisman selected the following nominating committee: H. F. Herrmann, Ephraim Freedman and George Baxter. A sectional committee consisting of three members was also to be nominated and elected at the following meeting.

Both Dr. Meili and Mr. Zisman referred to the importance of the coming sectional annual outing which was held on Friday, June 7th, at the North Jersey Country

Club, Paterson, N. J. A. J. Royce, chairman of the outing committee, advised that all plans had been completed for a full day of entertainment.

The Philadelphia Section informed us that they would hold their annual outing at Seaview Country Club on Saturday, June 15th, 1940.

P. J. Kennedy, general convention chairman, stated that plans have been completed for three full days of activity at the national convention in October. In addition to a full technical program, there will be sufficient activities arranged for the women guests. Also exhibits of merchandise of outstanding merit processed in this territory will be on display. We have also arranged with the New York World's Fair to have set aside as a "Special Day" for our association, Sunday, October 20th, 1940. At that time the special award for the outstanding technical paper will be presented at a luncheon.

There was a total attendance of 104.

Respectfully submitted,

P. J. KENNEDY, *Secretary.*

REPORT, NORTH CAROLINA STATE COLLEGE STUDENT CHAPTER

THE last speaker of the college year was Dwight L. Johnson, a graduate of State College, now with Procter & Gamble Co. He spoke on the manufacture and textile uses of soap.

Respectfully submitted,

WILLIAM S. PEARSON, *Secretary.*

MEMBERSHIP APPLICATIONS

Senior

George F. Blasius—Chemist, Dolphin Jute Mills, Paterson, N. J. Sponsors: W. D. Deuble, C. J. Rahm.

Henry H. Broadfoot—Research Asst. in Textile Technology, Mass. Inst. of Tech., Cambridge, Mass. Sponsors: F. J. O'Neil, E. R. Schwarz.

George Brownlee, Jr.—Research Dept., Callaway Mills, LaGrange, Ga. Sponsors: P. N. Collier, M. T. Johnson.

Leo E. Carroll—Vice President and Manager, Alabama Knitting Mills, Eufaula, Ala. Sponsors: W. F. Crayton, L. L. Bamberger.

Esther Naomi Chapman—Instructor, Pennsylvania State College. Sponsors: P. B. Mack, C. R. Phillips.

Charles A. Cohen—Research Chemist, Standard Oil Co. of N. J. Chemical Products Plant, Elizabeth, N. J. Sponsors: S. Edelstein, R. Hart.

Samuel Naeham Cummings—President, Pylam Products Co., New York, N. Y. Sponsors: J. E. Meili, W. W. Hales.

Walter L. Goddard—Supt. Dyeing and Finishing, Lorraine Mfg. Co., Pawtucket, R. I. Sponsors: H. V. King, A. R. Fletcher.

Kenneth R. Gray—Research Chemist, Rayonier, Inc., Shelton, Wash. Sponsors: L. A. Olney, H. C. Chapin.

James M. Jackson—Director of Organic Research, Kentucky Color & Chemical Co., Louisville, Ky. Sponsors: D. A. Anderson, K. A. Coate.

Quillian C. Jordan—Foreman of Cotton Dyeing, North Georgia Processing Co., Toccoa, Ga. Sponsors: G. Smith, E. MacNeill.

Alvin H. Leonard—Overseer of Dyeing and Weaving, Callaway Mills, LaGrange, Ga. Sponsors: M. T. Johnson, J. M. Youngblood.

Harold N. Logan—Chemist, Nashua Mfg. Co., Nashua, N. H. Sponsors: Jos. W. Russell, D. S. Clement.

Ernest M. May—Research Chemist, Otto B. May, Inc., Newark, N. J. Sponsors: H. B. Marshall, C. A. Funke.

Paul M. McLarty—Overseer of Finishing & Sanforizing, Thomaston Cotton Mill, Thomaston, Ga. Sponsors: H. R. Ivey, C. R. Gill.

Donald R. Neil—Asst. Dyer, Florence Thread Co., Riverside, N. J. Sponsors: J. P. Conaway, M. M. Guertin.

Clifford Franklin Nelson, Jr.—Bleacher, Thomaston Cotton Mills, Thomaston, Ga. Sponsors: H. R. Ivey, C. R. Gill.

Robert Harold Nuttall—In Charge of Textile Printing, Lanett Bleachery & Dye Works, Lanett, Ala. Sponsors: H. J. Gambert, L. L. Hamberger.

Thomas Louis Scala—Chemist, Colloids, Inc., Newark, N. J. Sponsors: O. F. Anderson, A. Malick.

Raymond J. Singer—Director of "Arthur Allen" Laboratory, Joseph H. Cohen & Sons, New York, N. Y. Sponsors: W. F. Prien, F. Krassner.

George A. Spear, Jr.—Chemist and Dyer, Enterprise Dye Works, Woonsocket, R. I. Sponsors: P. S. Crowell, I. L. Sheldon.

William Reginald Steele—Service Consultant, Solvay Process Co., Syracuse, N. Y. Sponsors: H. D. Clayton, H. C. Chapin.

Harold A. Sweet—Technical Sales Development, General Dyestuff Corp., New York, N. Y. Sponsors: C. Z. Draves, H. C. Borghetty.

Floyd Webster Warrington—Manufacturer's Agent, Charlotte, N. C. Sponsors: T. R. Smith, A. H. Gaede.

Eugene Banks Worrell—Manager, Acme Laundry Co., Columbus, Ga. Sponsors: L. L. Baker, L. L. Bamberger, T. A. Davis.

Junior

James E. Barnhill, Jr.—Dye-House Asst., North Georgia Processing Co., Toccoa, Ga. Sponsors: E. S. MacNeil, J. E. Gardner.

Robert D. Blum, Jr.—Chemist & Salesman, Stein Hall & Co., Inc., Charlotte, N. C. Sponsors: D. E. Truax, T. Larson.

William F. Brommelsick—Dyer, Forstmann Woolen Co., Passaic, N. J. Sponsors: W. vonBergen, E. H. Metzner.

Cecil B. Estes, Jr.—Laboratory Asst., Eagle & Phenix Hills, Columbus, Ga. Sponsors: W. P. Holt, W. F. Crayton.

John Anthony Feifer—Chemist, Perennial Dye & Print Works, West Warwick, R. I. Sponsors: P. Strengs, F. Whittaker.

Norman H. Nuttall—Chemist, Stein Hall & Co., Charlotte, N. C. Sponsors: D. E. Truax, F. W. Perry.

James A. Stapleton—Chemist, North Georgia Processing Co., Toccoa, Ga. Sponsors: G. Smith, E. MacNeill.

John Pope Thornton—Asst. Dyer, Callaway Mills, Hillside Plant, LaGrange, Ga. Sponsors: M. T. Johnson, A. Fisher, Jr.

Associate

Norman M. Agnew—Engineering Representative, International Salt Co., Charlotte, N. C.

J. Hudson Almand—Salesman, Penick & Ford, Ltd., Inc., Atlanta, Ga.

Henry Black—Asst. Gen. Manager, M. T. Stevens & Sons Co., North Andover, Mass.

Lester L. Brooks—Salesman, E. F. Houghton & Co., Griffin, Ga. Sponsors: C. Mueller, J. C. Sheehan.

Wilbur D. Evans—Manager, Runnymede Mills, Tarboro, N. C. Sponsor: W. S. Sims.

George Kampf—Superintendent, Briarcliff Inc., Atlanta, Ga. Sponsors: L. L. Baker, G. Smith.

Walter J. Kastner—Production Manager, National Oil Products Co., Cedartown, Ga.

William Jackson Kirby—Salesman, Penick & Ford, Ltd., Atlanta, Ga.

E. Kenneth Moore—Director of Research Laboratory, Fouke Fur Co., St. Louis, Mo.

Walter E. Scheer—Salesman, Commercial Solvents Corp., New York, N. Y.

ANNUAL MEETING AND CONVENTION

OCTOBER 18TH AND 19TH, 1940

HOTEL COMMODORE

NEW YORK CITY

OCTOBER 20TH, AT N.Y. WORLD'S FAIR

General Chairman

PATRICK J. KENNEDY

HONORARY RECEPTION COMMITTEE

Raymond Buser
M. S. Fargo, Jr.
E. Gossweiler
Herbert Grandage
E. K. Halbach
E. Maxwell
E. G. Robinson
Herbert Schell
William F. Zipse

Auspices of

NEW YORK SECTION

P. J. WOOD

Chairman, Honorary Reception Committee

THE chairman of the honorary reception committee for the twentieth annual meeting and convention will be P. J. Wood of the Royce Chemical Company. Mr. Wood needs no introduction as he has been active in the affairs of the association and an important figure in the textile industry for many years. He is a charter member of the association and was president of the parent body in 1930-1932 and at present is a member of the research and finance committees. The names of some of the leaders in the textile, dyestuff and chemical fields who will serve on this committee appear at the left.

TRADE NOTES • NEW PRODUCTS

• COMMENCEMENT, LOWELL TEXTILE INSTITUTE

The forty-second annual commencement exercises of Lowell Textile Institute were held in Southwick Hall on June 11th. Thirty-seven degrees and six diplomas were awarded. Judge Franklin W. L. Miles of the Roxbury district court gave the commencement address on the subject "Something for Nothing." The following graduates from the department of textile chemistry and dyeing were awarded degrees: master of science in textile chemistry— Bolek Lizak and Nicholas Valvanis; bachelor of textile chemistry—William Boyd, Jr., Andrew M. Campbell, Vernon W. Colby, Arthur S. Davis, John S. Gill, Richard T. Hall, Arthur W. Lanner, Edward M. Lynch, Jr., Edward J. F. Maslanka, William A. Nelson, Andrew F. Nuttall, Newell B. Ritchie, Safford P. Sweatt and Malcolm R. Woodward.

Prizes were awarded as follows: *Medal of the National Association of Cotton Manufacturers* to John A. Goodwin; *Louis A. Olney Book Prizes*—for students taking the textile chemistry and dyeing course—for graduating students, to Arthur S. Davis, honorable mention, Arthur W. Lanner; for second year students, first prize, George J. Mandikos, second prize, Irving P. Wolf, honorable mention, Arthur J. Moreau; for first year students, first prize, Richard E. Petersen, second prize, Peter DeMallie, honorable mention, William J. Sidebottom.

Other commencement activities included: June 6th—deep sea fishing trip on Ipswich Bay and the Pops Concert at Symphony Hall in Boston; June 7th—house party and outing at Ocean Park, Me.; June 8th—forty-first annual reunion of the Lowell Textile Institute Alumni Association; June 9th—baccalaureate service; June 10th—class day.

Awarded M.S. Degree at Lowell Textile Institute: Nicholas J. Valvanis and Bolek L. Lizak.

• LEIPZIG FAIR DATES

The Leipzig Trade Fair will hold its 1984th session from August 25th to 29th, inclusive. The historic international exchange has been held without interruption for more than 700 years.

• JUNE TEXTILE RESEARCH

Textile Research, monthly journal of the U. S. Institute for Textile Research, starts in its June issue publication of progress reports of its research on textile drying that is now nearing completion at the National Bureau of Standards. The first instalment describes the research equipment, and a second report will appear in the July issue under the title "The Moisture Relations of Textile Fibers and Elevated Temperatures." The objective of the study was the drying of textiles without fiber damage. Also appearing in the June issue is the eighth of a series of reports of the Institute's completed research on the warp sizing of filament viscose rayon entitled "Behavior of Gelatins and Glues in Size Baths of Low Concentration."

The second of a series of three reports of the study of "Viscose Rayon: Stress-Strain Properties," by H. R. Bellinson working at M. I. T. under Prof. E. R. Schwarz, also appears in the June Textile Research. This study has been conducted under a Textile Foundation grant, and this report covers "Effect of Rate of Load," and will be concluded next month with a report on "Effect of Relative Humidity." The completed report will form a notable contribution to scientific knowledge of the subject.

• GENERAL RELEASES

General Dyestuff Corp., 435 Hudson Street, New York, N. Y., has recently released circulars describing the following products:

Celliton Fast Yellow 3 G A—a bright, greenish-yellow, recommended by the manufacturers for the dyeing of acetate rayon. It is said to be particularly suited for the production of bright greens with such bright blues as Celliton Fast Blue FFRS. The new product is said to possess very good fastness to light and to rubbing and to have excellent affinity and dispersion and can be used as a shading color in acetate diazo colors, as it is not changed by Developer ON. Circular G-181.

Benzoform Red 7 B—a direct color suitable for aftertreatment with formaldehyde. It produces a full bluish red said to be of good fastness to washing, water and perspiration and to be dischargeable to a good white. The color is principally recommended by the manufacturers for the dyeing of dischargeable shades on rayon. Circular G-182.

Direct Deep Black G R Conc.—which represents a slightly redder shade than their principal greenish brand of Direct Deep Black E A Extra, but is otherwise identical in all its properties. Circular G-183.

• NORDSTROM VALVE PRICE LIST

A new 48-page condensed price list, Bulletin V-109, covering all types and sizes of Nordstrom valves has just been issued by Merco Nordstrom Valve Company.

Students Awarded the Degree of Bachelor of Textile Chemistry at the Lowell Textile Institute.

A comprehensive pressure rating index by metals to Nordstrom valve bulletins is included in the forepart of this bulletin. By referring to this index, quick determination of the proper valve figure number to meet various conditions of pressure, pipe size, connections and method of operation can be found. This index also lists the bulletin number and page on which each figure number is cataloged.

Copies of this price list can be obtained by addressing Merco Nordstrom Valve Company, 400 N. Lexington Avenue, Pittsburgh, Penna.

• COMMENCEMENT, NORTH CAROLINA STATE COLLEGE

Following the baccalaureate address by Governor Clyde R. Hoey at its 51st annual commencement program on June 3, North Carolina State College conferred degrees upon 65 students who had completed the prescribed work in the Textile School and honored Charles A. Cannon of Concord with the degree of Doctor of Textile Science. Mr. Cannon is president of the Cannon Mills at Kannapolis and a nationally known figure in the textile industry.

John M. Mauney of Lincolnton was awarded the medal of the National Association of Cotton Manufacturers.

Dr. Thomas Nelson, Dean of the Textile School, said that 90 per cent of this year's graduates have definitely been placed in textile positions and that all the others are in communication with one or more prospective employers and will probably be placed before the end of the week. Requests for graduates of the Textile School this year, according to Dr. Nelson, have exceeded the number of men in the graduating class. A large percentage of he 1940 graduates will be located in North Carolina, but 12 other states and two foreign countries will also have one or more of this year's class.

The following graduates were awarded the degree of bachelor of science in textile chemistry and dyeing: C. F. H. Begg, C. P. Echerd, T. K. Fang, E. W. Fisher, J. W. Fredericks, Jr., R. B. Kelly, T. F. Parks, W. H. Ritter, J. J. Ryan, Seymour Schandler, M. L. Selsinger, J. E. Tillman, F. A. Walker, C. K. Watson, A. R. Williams, Jr., and L. J. Winiarski.

• NEW SANFORIZING AGENT

Sanfosist, a combined wetting and finishing agent, is a new member in the line of synthetic finishes developed by the Alrose Chemical Co. of Providence, R. I. It is stated that, after several months of continued successful operation in some of the larger mills, Sanfosist has been fully developed and proven its worth. It is now offered to the Sanforizers generally.

Sanfosist is said to be a complete product and to combine in itself both a durable finish and a powerful wetting-agent. Cloth can be treated with Sanfosist and held over for an indefinite period before Sanforizing without appreciably losing its rewettability, it is said.

Sanfosist is being applied to all kinds of cellulosic fabrics and the method of application can be varied to suit practically all constructions. In many cases it is being applied in the desizing bath, thereby eliminating one finishing operation. Cloth which has been first treated with Kiersist in the kier-boil and then finished with Sanfosist will sanforize with a markedly lower shrinkage loss, it is claimed.

• ELECTED CHAIRMAN

Dr. Donald Price, Technical Director, Organic Research Laboratories, for the National Oil Products Co., of Harrison, N. J., was elected chairman for 1940-41 of the Metropolitan Microchemical Society at the ninth regular meeting of the group at Fordham University, on May 23. Dr. Price succeeds Dr. Alexander Knoll of Columbia University.

Other officers elected included Harold V. Wadlow, of the Bell Telephone Laboratories, as vice-chairman, and Dr. Julius A. Kuck of the College of the City of New York, as Secretary-Treasurer. Prof. A. Benedetti-Pichler, of New York University, and Dr. Knoll were elected members of the Executive Committee.

• PHI-Φ-SOL

Onyx Oil & Chemical Co., Jersey City, N. J., has recently published a booklet entitled "Phi-Φ-Sol," describing this product which is a sulfated ester of a fatty acid. The foreword states:

"The evolution of the dye and textile industries, with their host of new fibers and colors, makes necessary, dyeing and finishing auxiliaries of increased potency for successful performance. Phi-Φ-Sol, a dye penetrant, color leveler and wetting agent, possessing exceptional values, is one of the Onyx Oil & Chemical Company's contributions to these rapidly expanding industries. Dyers and finishers, who are encountering difficulties in producing commercially acceptable merchandise or who wish to improve the quality of their dyed textile products, will find Phi-Φ-Sol a useful adjunct in their textile operations. It is to these dyers and finishers that this pamphlet is especially directed."

Methods of application of the product on the various fibers for its different uses are given. Copies are available upon request to the Onyx company.

• ALFRAMINE D C A

The Michel Export Co., Inc., 90 Broad Street, New York, N. Y., has recently issued a booklet entitled "Alframine D C A —A Soapless Soap." Alframine D C A is a sulfonation product of a high molecular aldehyde condensate of the aliphatic series. In combination with other less active chemical compounds, Alframine D C A is a yellowish white, medium heavy powder, with which its colloidal character is said to be completely harmonious. The booklet describes the properties of the product and its uses in various industries, including the textile. Copies of the booklet are available upon request.

• NEW RESIN FINISH

According to an announcement being released currently to the Textile Industry by Calco Chemical Division, American Cyanamid Company, Aerotex Resin 105 is said to offer substantial economies and marked product improvement in the finishing of cotton and rayon yard goods.

As described in Calco's announcement, the application of this new sizing requires no change in present finishing equipment. It is stated that Aerotex 105 is a milky white liquid, completely dispersable in water at room temperature, and has the added advantage of being miscible with all other finishing gums and softeners.

Economies in application are said to result from the fact that Aerotex 105 requires no cooking, and may be introduced directly into the pad box. All that is required to set the resin is tenter heat at 250° F., and yard goods so treated are said to retain their resilient finish after repeated commercial launderings.

Improved appearance and hand is obtained compared to customary starch finishes since there is no dimming of colors or clouding of whites when Aerotex 105 is used, it is said.

Full details are covered in Calco's new Technical Bulletin No. 557, which is available as well as free working samples from Calco representatives.

• NEW SOLVAY BOOK

Solvay Sales Corporation has just issued a new 84 page Technical and Engineering Service Bulletin No. 8 entitled "Alkalies and Chlorine in the Treatment of Municipal and Industrial Water."

This new book presents a detailed discussion and analysis of the various techniques that are used in treating both municipal and industrial water supplies. It contains charts, tables and other data that are invaluable to the water engineer.

Bulletin No. 8 is the second Solvay publication on this subject. A prior publication, known as Bulletin No. 11, discusses water analysis methods for municipal and industrial use. Both these technical bulletins are available without charge. Write to Solvay Sales Corporation, 40 Rector Street, New York, N. Y.

• ATLANTIC RAYON SCHOLARSHIP

The Atlantic Rayon Scholarship was awarded on May 29th to Frederick B. Read, Jr., by Royal Little, president of the Atlantic Rayon Corporation. The scholarship was established by the corporation in March of this year at the Rhode Island School of Design and is awarded by a committee of three, two from the school, and one from the corporation, to the student deemed most likely to become a successful textile executive in the future.

It is stated that the purpose of the scholarship is to stimulate the study of rayon and the conversion of rayon into fabrics. The winner is to spend a year in as many establishments as can be arranged, beginning with the production of pulp and ending with the retail distribution of rayon fabrics.

• TECHNICAL NOTES FROM FOREIGN SOURCES •

The Action of Alkylene Oxides on Cellulose

Lawrie, Reynolds and Ward—J. Soc. Dyers and Col., 56-1, *Jan.*, 1940.—Of the series of alkylene oxides, ethylene oxide, CH_2CH_2O, a colorless, mobile liquid boiling at about 12° C., is at once the simplest in structure and chemically the most reactive. Its property of readily condensing with hydroxyl groups led the authors to examine into the possibility of its reacting with cellulosic material in such a way as to allow the production of novel finishes, without disturbing the fundamental fibrous character of the material.

It was found that if cotton material is first activated with caustic soda and then treated with controlled quantities of ethylene oxide a marked change in the properties of the material results. Stiffness and transparency of the fabric are enhanced, and cloth so treated lends itself remarkably well to an interesting variety of finishes. Propylene oxide and hydroxypropylene oxide (glycide) give similar results, but as these compounds are much less accessible than ethylene oxide their reaction remains largely of theoretical interest. Trials were also made on viscose rayon, linen and jute fabrics, but results were not encouraging, and the process appears to be best suited to use on cotton material.

Chemically, the reaction that takes place is viewed as probably a simple etherification, the formation of soda-cellulose being followed by reaction of the activated hydroxyl groups with ethylene oxide.

As developed by the authors, the process consists essentially in treating selected cotton fabrics with caustic soda, either by impregnating or by printing, and then subjecting them without drying, though expressed or hydro-extracted if impregnated, to the action of ethylene oxide, either in the form of gas or preferably dissolved in carbon tetrachloride. The fabric is then acidified, washed and bleached to remove any color formed during the reaction, and after drying is ready for the appropriate finishing process.

Effective alkali treatment was found to lie within a range of caustic concentrations running from 9.5 per cent to 22.5 per cent. Below this cotton was not sufficiently activated to react with the ethylene oxide, while above it no appreciable increase in activity was observed. Time of immersion in the caustic did not appear to effect results, provided that the cloth was thoroughly wetted with the liquor, and as all treatments were carried out at room temperature, the effect of varying temperatures was not observed.

Dissolving ethylene oxide in carbon tetrachloride was found to be the most convenient method of applying the reagent to the caustic-treated fabric. Final results could be controlled by varying concentrations in the solvent bath, a reasonable cloth-liquor ratio being always maintained. In relation to the strength of alkali treatment previously given, amounts of ethylene oxide ranging from 10 per cent up to 40 per cent on the weight of the cloth were employed. The reaction proceeds slowly at relatively low temperatures, at 20°-25° C. requiring approximately 18 hours for completion, but could be speeded up by increasing the temperature, so that at 50° C. only 2 hours' treatment was required.

Two main variations in the resulting fabric properties can be produced by the treatment thus outlined. Linen-like effects are secured when the lower concentrations of alkali and ethylene oxide are employed, while at the higher concentrations, of which 40 per cent of ethylene oxide on the weight of the cloth represents the maximum that can be used without seriously effecting fabric strength, organdie-like effects result. The type of finishing treatment used on such fabrics is important, and must be suited to the cloth, to the degree of treatment it has received and to the particular effect desired. For example, if cloth of appropriate weave is energetically treated and finally finished by dampening heavily and calendering, a highly transparent result is obtained. Schreiner finishing of highly treated cloths, especially of sateens, produces a material similar to tracing cloth.

The practical applications of this process and the range of effects it is capable of producing are described in detail. All-over effects are listed as "organdie-like," "linenized" and "parchmentized"; printed effects as "window-pane," "printed damask," "figured velveteen" and "lace." Four sample cuttings from this list accompany the article. Perhaps the most striking is the parchmentized effect and its printed equivalent, the "window-pane," obtained by calendering strongly treated cloths, a method which produces fabrics highly transparent and almost glass-clear. Such a finish is not permanent, in that it may be destroyed by wetting, but the fundamental modification of the cloth is permanent, for the finish may be readily restored by re-calendering.

The ethylene oxide process, which is covered by several Empire patents, is considered capable of producing by one general method just such effects as have been previously produced in a variety of ways—for example, organdie effect by sulfuric acid treatment, stiffened finishes by use of cold caustic soda, etc.—and in addition the highly transparent parchmentized and "window-pane" effects which are believed to be unique and not obtainable by any other means.

The communication is from the Dyestuffs Group of the Imperial Chemical Industries, Ltd.

Aqueous Rubber Dispersions—

(Concluded from page 312)

TABLE I

Tensile Strengths of Latex—Rubber Dispersions Mixtures

% Latex Solids	Solids % Dispersion	Tensiles from Red Tube Reclaim	Tensiles from Whole Tire Reclaim
100	0	6100 lbs.	6100 lbs.
75	25	4800 lbs.	4500 lbs.
50	50	4000 lbs.	3900 lbs.
25	75	3200 lbs.	3100 lbs.
10	90	2500 lbs.	2100 lbs.
0	100	1500 lbs.	1075 lbs.

However, rubber dispersions may be used extensively in admixture with rubber latex with good savings wherever high tensile strengths are not a prime requisite.

No article of contemporary nature on rubber-fiber combinations would be complete without some mention of the aggressive work being carried out at present to combine the favorable properties of each. It has been the object of many research workers to develop processes whereby fibrous materials, especially woolens, after being impregnated with rubber or latex solutions, should retain their natural feel and not the "rubbery" feel of the impregnant. Blow and his co-workers[7] have attempted to accomplish this by the addition of cation active compounds to the latex solutions, and much of this work has been reviewed by the writer[8].

Recently a process[9] has been developed which attained this objective, i.e., to treat fibrous materials like woolens with latex and to deposit the rubber in such a manner so that the final product maintained the original fabric feel, as well as appearance of the untreated fibrous material. Here the fabric substantially free from coagulant is maintained in contact with a relatively small amount of latex composition which has a pH approximately in the isoelectric zone of the fibrous material. The latex contains enough and not much more than enough of a protective agent, so as to make it stable at the temperature of treatment, when not in contact with the fabric, but unstable when in contact with the fibers.

An example of a typical latex compound which may be used is as follows:

Compounding Ingredient	*Purpose*	*Parts by Weight*
60% latex (centrifuged type)		100
Potassium hydroxide (25% solution)	Stabilizer	2
Glue (25% solution)	Protective agent	0.4
Sulfated fatty alcohol (10% solution)	Wetting agent	1.25
Mercaptobenzothiazole (35% paste)	Accelerator	0.5
Zinc dimetyl-dithiocarbamate	Accelerator	0.5
Solubilized casein	Protective agent	4
Colloidal sulfur	Vulcanizing Agent	2
Colloidal zinc oxide	Activator	2.5
Ketone amine	Anti-oxidant	0.5
Water	Diluent — Enough to make composition of 40% solids.	

For impregnating wool flannel fabric, a bath of the following composition is prepared which contains in parts by weight:

	Parts by Weight
Solids of above latex compound	10
75% sulfonated castor oil (stabilizing agent)	3
Formic acid	2.7
Water	84.3

This bath is adjusted to a pH of 2.6 which is in the isoelectric range of wool.

The flannel fabric is impregnated with the above diluted latex mixture, and then allowed to stand at room temperature for 60 minutes. In this time substantial exhaustion of the latex solution takes place, and close to 12 per cent of solids will deposit on the fabric. This treating bath, with a pH of 2.6, is sufficiently stabilized so that in the absence of wool fibers at room temperature no coagulation will take place.

From a purely theoretical point of view, it is interesting to note that Duarry[10] was able to impregnate fibrous materials thoroughly, instead of just surface coating them, by applying the dilute latex stabilized with sodium silicate to the fibers under high pressure in an autoclave.

The application of rubber to textile materials from aqueous media is a natural step, as many textiles require the flexibility and added strength of rubber for certain uses. In spite of the fact that we are dependent upon foreign sources for rubber latex, it has fallen to the lot of the processors of rubber dispersions to moderate any drastic increases in the latex market, as we have described in the foregoing.

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• CLASSIFIED •

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